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(54) **Clutch disk for a friction clutch**

(57) The invention relates to a clutch disk with torsional oscillation dampers for the load range and the idling range. A friction stage which is used after a predetermined angle of rotation in the idling range is coupled to corresponding idling range damping springs 13 and comprises friction segments 28 arranged in peripherally enlarged apertures for the associated springs 13 and lying directly on the peripheral ends of the springs. The apertures are peripherally greater in design than the length of the springs including the peripheral dimension of the friction segments.

Fig. 3

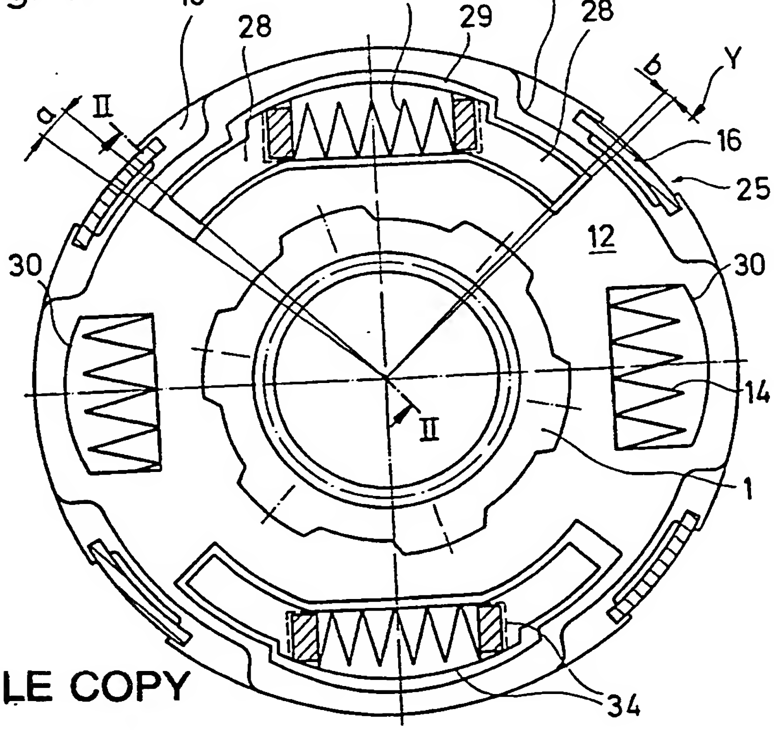

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Fig. 1

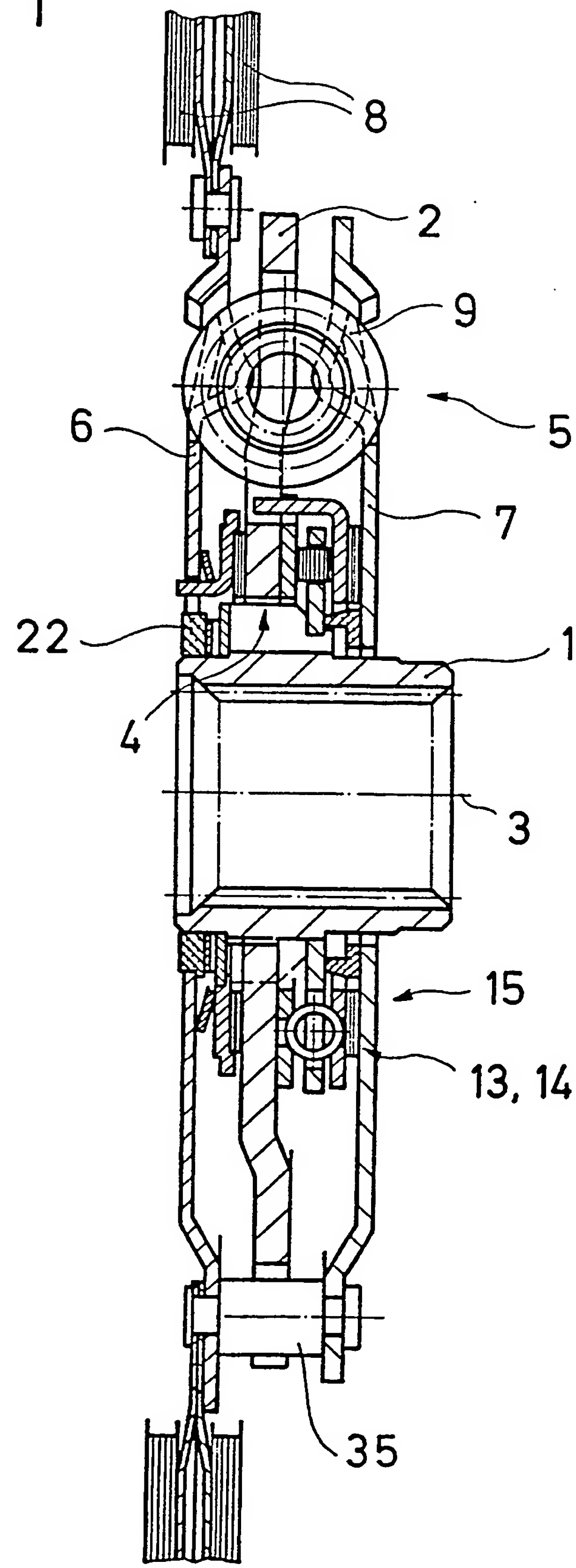

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Fig. 2

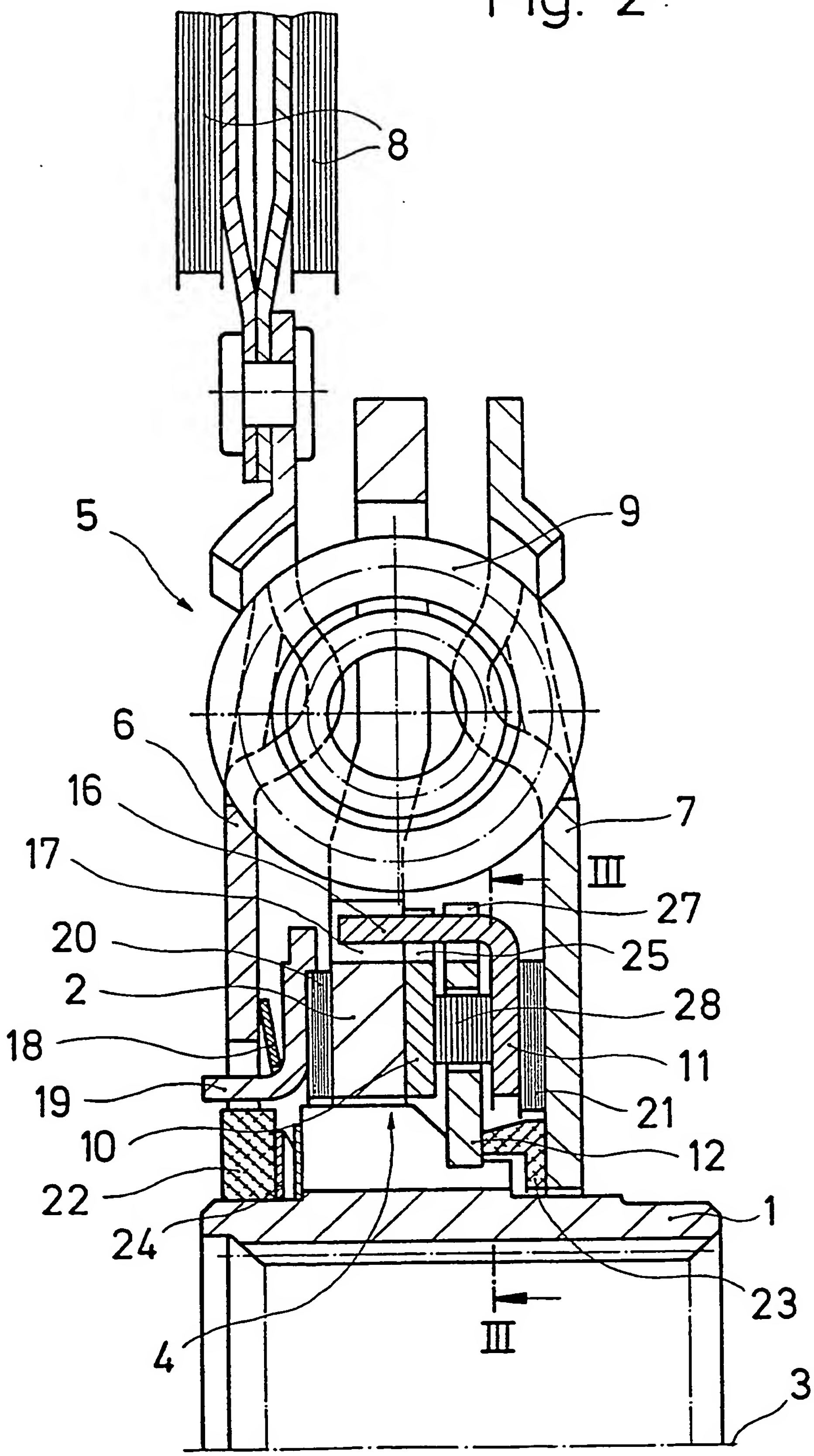

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Fig. 3

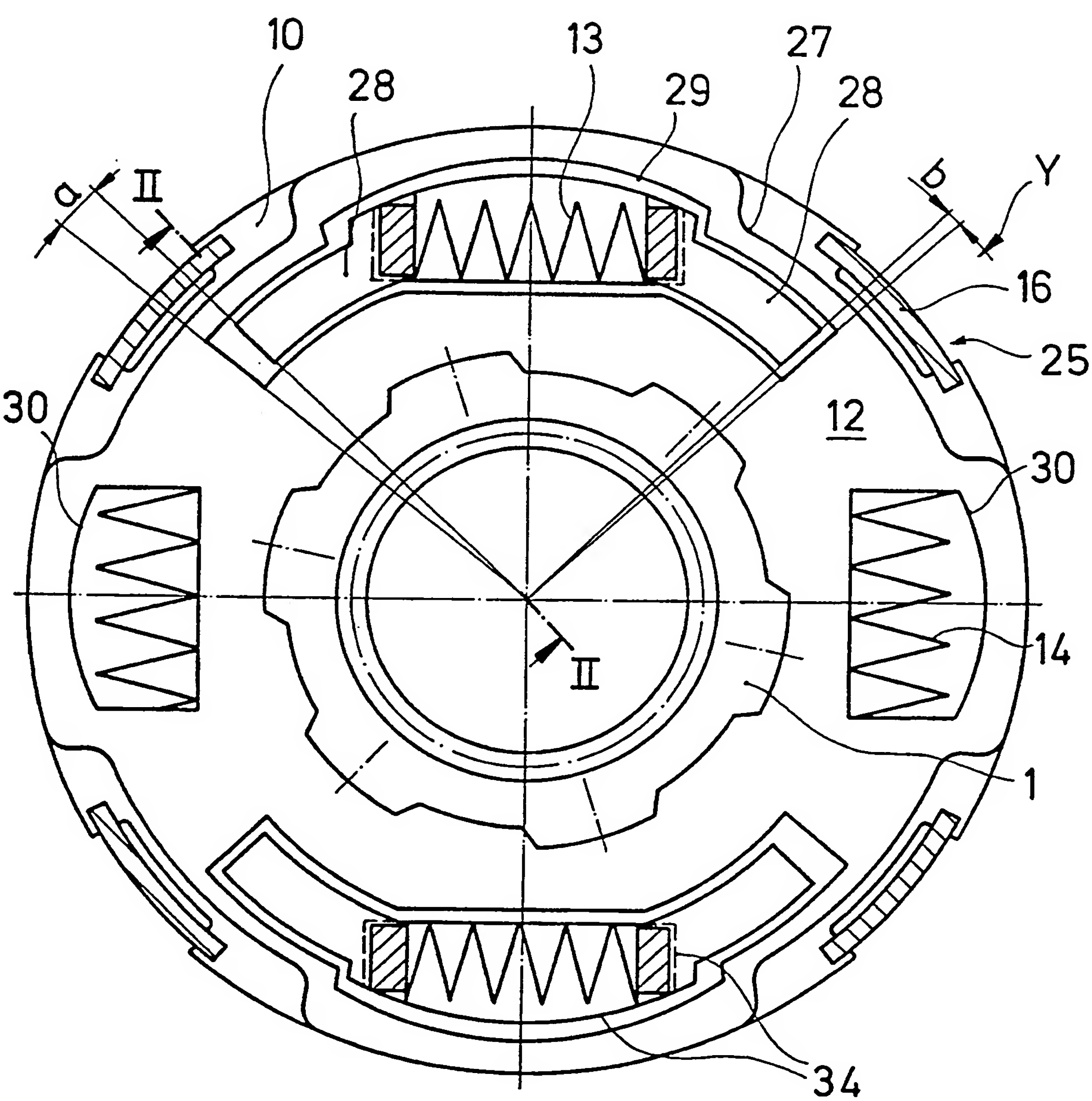


Fig. 4

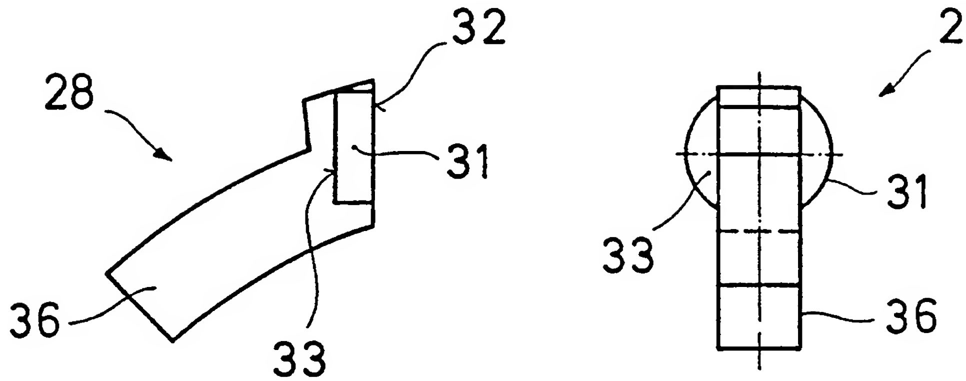
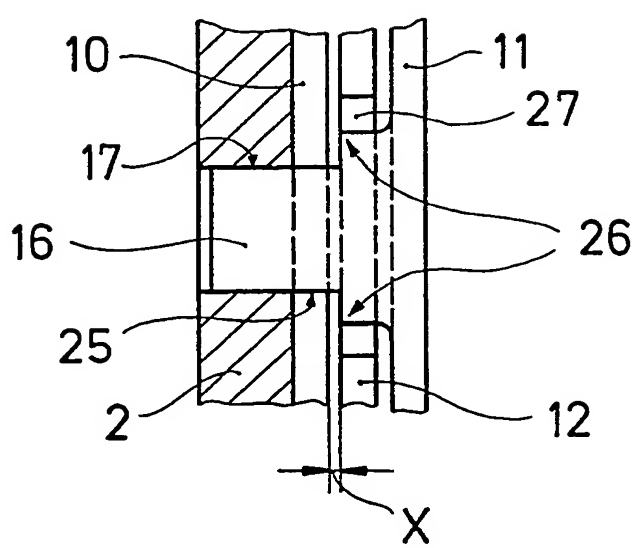


Fig. 5



CLUTCH DISK FOR A FRICTION CLUTCH

The invention relates to a clutch disk with torsional oscillation dampers for a friction clutch.

A clutch disk of this type is known, for example, from DE-OS 3 345 409. This known clutch disk has an idling friction device which, together with corresponding springs, forms an idling oscillation damper. However, the adaptability of such a system is restricted and therefore does not always lead to the desired result.

An object of the present invention is to provide a clutch disk with an idling system having a two-stage friction device.

According to the invention there is provided a clutch disk assembly for a friction clutch comprising a hub; a load oscillation damper with two lateral disks which are connected to one another and are rotatably mounted on the hub, with a hub disk which is arranged axially between the lateral disks and is coupled to the hub with rotational play by means of teeth, with several load damping spring coupling the lateral disks torsionally elastically to the hub disk and with a load friction device; an idling oscillation damper with at least one input disk part which is arranged between the hub disk and one of the lateral disks and is connected non-rotatably to the hub disk, an output disk part arranged non-rotatably on the hub axially between the hub disk and one lateral disk, with at least one idling damping spring which torsionally elastically couples the disk parts to one

another, is held in axially opposed recesses in the disk parts and with an idling friction device; and friction linings held on one of the lateral disks of the load oscillation damper, characterised in that the idling friction device has at least one friction segment which is movable relative to the input and output disk parts in the peripheral direction thereof, is in frictional contact with a first of the disk parts and couples the idling damping spring to a second of the two disk parts with inclusion of an idling rotational play.

By arranging a friction device which becomes effective in a protracted manner and acts after a partial rotation, in conjunction with a spring device, which is used together with the further friction device, it is possible to create, within the idling range, a two-stage friction device which, when suitably adapted, leads to the desired result even with very sensitively reacting motor vehicle drives, more specifically even with different requirements of the type arising owing to the differences between cold and hot gearing, the torsional damping properties normally being more desirable with cold gearing but a greater idling torque having to be transmitted. In this respect, it is desirable that a spring stage is also used simultaneously with the higher frictional force. These springs ensure the exact return of the friction segments when the movement is reversed. The first friction stage acting in the entire idling operating range can be embodied by the

inherent friction of the damper or by a further idling friction device.

The springs of this spring stage which is used in a protracted manner are arranged in peripherally enlarged apertures in the hub disc and to each face end there is attached a friction segment which fills the axial space within the idling oscillation damper and is axially loaded by the spring of the load friction device. Therefore a separate spring is not required for the additional friction stage and the friction segment can be equipped with an adequate friction volume.

The friction stage which acts in a protracted manner is preferably constructed symmetrically in that two springs which are substantially diametrally opposed to one another are provided with two respective friction segments.

For certain cases of adaptation it is also advantageous to provide, in addition to the springs co-operating with the friction segments, further springs which act over the entire idling range and alternate peripherally with the other springs. This produces a symmetrical arrangement of the idling system and automatic resetting of the entire system when the torque is released.

The springs co-operating with the friction segments are advantageously inserted with axial initial tension into the corresponding apertures. This ensures that, when the direction of rotation is reversed, the friction segments maintain their effect over the entire proposed range of rotation owing to the initial tension of the springs.

As the input disk parts of the idling system are shifted toward one another over a prolonged period owing to the wear of the friction segments, it is proposed that the axially

angled flaps of one input disk part which produce the non-rotatable connection to the other disk part and to the hub disk of the load system be constructed with steps which, after the proposed wear volume is used up, come to rest on the other disk part and thus protect the springs of the idling system from axial gripping.

As an advantageous further embodiment of the friction segments, it is proposed that the friction segments be constructed as spring plates in the region immediately adjacent to the springs in that they have a preferably circular disk-like projection which has a contact face directed toward the spring and, in the opposite direction and at a distance therefrom, contact edges for the apertures in the input disk parts. The force transmission from the spring to the friction segment can therefore be optimised and this is to the benefit of both the service life of the spring and the service life of the friction segment.

The invention will now be described by way of example with reference to the accompanying drawings in which:

FIGURE 1 is the section through a complete clutch disk,

FIGURE 2 is the enlarged view of the upper half of the clutch disk corresponding to section II-II in Figure 3,

FIGURE 3 is the section III-II according to Figure 2 showing the components of the idling system,

FIGURE 4 is the side and front view of a friction segment, and

FIGURE 5 is the partial view Y according to Figure 3.

Figure 1 shows the longitudinal section through a clutch disk with an idling system and a load system. The hub 1 is placed onto a gearshaft (not shown) and a hub disk 2 is connected thereto via teeth 4, the teeth 4 having rotary play which determines the region of action of the idling system. All parts of the torsional oscillation damper are arranged concentrically round an axis of rotation 3. The hub disk 2 is surrounded on one side by a lateral disk in the form of a lining carrier 6 and on the other side by a lateral disk constructed as a covering plate 7.

The two parts are non-rotatably connected to one another by spacer rivets 35 and are kept at a predetermined distance from one another. The lining carrier 6 is provided with friction linings 8 in the region of its outer periphery. The torque is introduced via the friction linings 8 through a clutch (not shown). Damping springs 9 which represent the torsional spring 5 for the load system are arranged in apertures of lining carrier 6, covering plate 7 and hub disk 2. The torsional spring 15 for the idling system is inserted between the hub disk 2 and the covering plate 7, more specifically over a mean diameter which is smaller than the diameter of the region formed by the springs 9. The details of the idling system with its damping springs 13 and 14 as well as the other components are described in more detail later on with reference to the other Figures. Lining carrier 6 and covering plate 7 are mounted via a guide ring 22 which is held non-rotatably on the lining carrier 6 and is placed onto a cylindrical step of the hub 1.

Figure 2 shows the upper half of the section through the clutch disk on an enlarged scale. In contrast to Figure 1, two input disk parts in the form of covering plates 10 and 11 of the idling system are shown here, wherein the first covering plate 10 rests directly on the hub disk 2 and the second covering plate 11 which is provided in the region of

its outer periphery with axially angled flaps 16 which engage peripherally without clearance in openings 25 in the covering plate and openings 17 in the hub disk 2 for non-rotatable connection is arranged at a distance from the hub disk 2. An output disk part, constructed as a hub disk 12, of the idling system is penetrated in peripherally enlarged openings 27. Friction segments 28 which determine the axial spacing between the two covering plates 10 and 11 are inserted between the two covering plates 10 and 11 - as shown in particular in Figure 3, section III-III. Figure 2 shows further friction elements, for example the friction ring 21 between covering plate 7 and covering plate 11 as well as the friction ring 20 between hub disk 2 and lining carrier 6, a further pressure ring 19 and a Belleville spring washer 18 also being arranged here. The last-mentioned friction elements serve to produce the frictional force in the load system. A friction device which serves to produce the basic friction and acts over the entire angular range of rotation is also provided. It consists of the corrugated spring 24 between hub 1 and guide ring 22 and of the angled ring 23 inserted between covering plate 7 and hub disk 12.

The design of the idling system in the peripheral direction is shown in particular in Figure 3. The hub disk 12 for the idling system is shown here through the section III-III - with various apertures and various damping springs. The springs 14 in the apertures 30, two of which are arranged opposite one another in a pair, are inserted peripherally into the apertures without clearance. These springs 14 therefore act over the entire idling range. Suitable apertures are obviously also arranged in the two covering plates 10 and 11. The springs 13 are arranged in the apertures 29, which are peripherally extended in design, of the hub disk 12. The extended parts of these apertures 29 are designed to receive the friction segments 28. The friction segments - the external form of which is shown in

Figure 4 - extend with their friction body 36 peripherally into the apertures and fill them apart from certain end regions. In the regions facing the springs 13, they are provided with a disk-shaped annular projection 31 which has a diameter corresponding to the diameter of the springs 13 and rests via a contact face 32 on the ends of these springs. A respective contact edge 33 with which the friction segments 28 are held in the apertures 34 of the covering plates 10 and 11 is provided at a distance from the contact face 32 - as viewed in the peripheral direction. The friction bodies 36 are radially smaller in design than the radial dimension of the projections 31, i.e. are radially inwardly stepped. However, this design is adopted merely for reasons of space as the axially bent flaps 16 of the second covering plate 11 extend radially outside the friction bodies 36 and, for this purpose, peripherally enlarged openings 27 have to be provided in the hub disk 12. The construction illustrated in Figure 3 produces an ineffective angular range of rotation by the amount a in one direction and by the amount b in the other direction for the friction segments 28 and the springs 13. The partial rotations a and b are produced with the adaptation to a specific vehicle and can also be equally large or can also tend to zero in one direction of rotation.

Figure 5, corresponding to partial view Y in Figure 3, shows the design of the axially angled flaps 16 of the covering plate 11. These flaps 16 penetrate, without clearance in the peripheral direction, openings 25 in the covering plate 10 for mutual non-rotatable connection and also penetrate, without clearance in the peripheral direction, in openings 17 in the hub disk 2. The two covering plates 10 and 11 are therefore non-rotatably connected to one another and to the hub disk 2, but the covering plate 11 is held in an axially movable manner. The hub disk 12 is penetrated in peripherally enlarged openings 27. The flaps 16 are accordingly equipped with steps 26

which widen the flaps 16 and, in the fitted state, are at a distance x from the side of the covering plate 10 facing the covering plate 11. This fitted situation is produced in the new state in that the internal clearance between the two covering plates 10 and 11 is determined by the axial dimension of the friction bodies 36 of the friction segments 28. The steps 26 thus serve to protect the springs 13 and 14 from axial gripping in the case of inadvertent excessive wear of the friction segments 28.

The torsional oscillation damper accordingly operates as follows:

During idling, the components 6, 7 and 2 should be considered peripherally as a unit owing to the spring force of the springs 9 and they move without mutual rotation in the region of the play of the teeth 4. The basic friction device consisting of components 22, 23 and 24 acts during this rotation, during which the springs 14 are compressed. The corrugated spring 24 can itself be considered as a friction element which presses the angular ring 23 against the radially inner region of the hub disk 12. The force of the corrugated spring 24 is transmitted via the two covering plates 6, 7 and the spacer rivets 35. After covering the partial rotation a or b - depending on the direction of torque loading - the second stage of the idling friction device comes into effect in addition to the basic friction device in that the two friction segments 28 - which are diametrally opposed - come to rest at the peripheral end of the aperture 29 in the hub disk 12 and a relative movement takes place between the two covering plates 10 and 11 and the corresponding friction segment 28. The springs 13 are simultaneously compressed. After the play in the teeth 4 has been exceeded, the hub disk 2 of the load system together with the two covering plates 10 and 11 of the idling system comes to rest by striking against the hub 1 and against the

hub disk 12 so that the springs 13 and 14 are no longer loaded and the frictional force contribution of the friction elements 28 drops away. During further movement of lining carrier 6 and covering plate 7, the springs 9 are accordingly tensioned and the load friction device consisting of the friction rings 20 and 21 and of the pressure ring 19 non-rotatably connected to the lining carrier 6 and the Belleville spring washer 18 additionally comes into use. The basic friction device obviously also acts in addition to this load friction device. Owing to the axially rigid connection between lining carrier 6 and covering plate 7 via the spacer rivets 35, the force of the Belleville spring washer 18 is transmitted to the side of the covering plate 7 and therefore provides not only the axial pressing force for the parts of the load friction device but also the axial pressing force for the friction segments 28. A separate spring for producing the pressing force for the friction segments 28 is therefore unnecessary. As already indicated, the steps 26 of the flaps 16 of the covering plate 11 protect the springs 13 and 14 from axial gripping in the event of unexpectedly high wear of the friction segments 28. Although the second friction stage in the idling system is therefore cancelled all other functions are fully retained.

The number of springs 13 and 14 for the idling system can be selected in the traditional manner. Similarly, the friction segments without disk-shaped projections 31 can be used and are then simpler in design. The axial initial tension of the springs 13 serves for secure frictional insertion during reversal of the direction of rotation, wherein the spring force must be greater than the suppression produced by the frictional force. Only in this case is it ensured that the corresponding friction segment will not perform a premature rotational movement owing to frictional gripping in the event of a reversal of the direction of rotation. It should also be noted that the springs 14 not

coupled to additional friction device can be dispensed with directly. A region of free rotation in which only the basic friction acts is thus formed in the region of rotation between the insertion points of the additional friction device and the springs 13.

CLAIMS:

1. A clutch disk assembly for a friction clutch comprising a hub (1); a load oscillation damper (5) with two lateral disks (6, 7) which are connected to one another and are rotatably mounted on the hub (1), with a hub disk (2) which is arranged axially between the lateral disks (6, 7) and is coupled to the hub (1) with rotational play by means of teeth (4), with several load damping springs (9) coupling the lateral disks (6, 7) torsionally elastically to the hub disk (2) and with a load friction device (18-21); an idling oscillation damper (15) with at least one input disk part (10, 11) which is arranged between the hub disk (2) and one (7) of the lateral disks (6, 7) and is connected non-rotatably to the hub disk (2), an output disk part (12) arranged non-rotatably on the hub (1) axially between the hub disk (2) and one lateral disk (7), with at least one idling damping spring (13, 14) which torsionally elastically couples the disk parts (10, 11, 12) to one another, is held in axially opposed recesses (29, 30, 34) in the disk parts (10, 11, 12) and with an idling friction device (22, 23, 24, 28); and friction linings (8) held on one of the lateral disks (6, 7) of the load oscillation damper (5), characterised in that the idling friction device (22, 23, 24, 28) has at least one friction segment which is movable relative to the input and output disk parts (10, 11, 12) in the peripheral direction thereof, is in frictional contact with a first (10, 11) of the disk parts (10, 11, 12) and couples the idling damping spring (13) to a second (12) of the two disk parts (10, 11, 12) with inclusion of an idling rotational play (a, b).

2. A clutch disk assembly as claimed in claim 1, wherein the friction segment (28) is arranged at least in part in a peripherally extending enlargement of the recess (29), holding the idling damping spring (13), of the second disk part (12) and rests on the peripherally adjacent face end of the idling damping spring (13).

3. A clutch disk assembly as claimed in claim 2, wherein peripherally on both sides of the idling damping spring (13) there are provided friction segments (28) which are coupled *via* the idling damping springs (13) to the second disk part (12), the idling rotational play (a, b) being provided in the rotational path of at least one of these two friction segments (28).

4. A clutch disk assembly as claimed in claim 1, 2 or 3, wherein the idling oscillation damper (15) has two approximately diametrally opposed idling damping springs (13) which are coupled *via* friction segments (28) to the second disk part (12).

5. A clutch disk assembly as claimed in any one of claims 1 to 4, wherein the idling oscillation damper (15) comprises, in addition to the idling damping spring (13) coupled *via* the friction segment (28) to the second disk part, at least one further idling damping spring (14) torsionally elastically coupling the two disk parts (10, 11, 12) to one another without idling rotational play.

6. A clutch disc assembly as claimed in claim 5, wherein the idling damping springs (13, 14) torsionally elastically coupling the disk parts (10, 11, 12) to one another with idling rotational play and without idling

rotational play alternate in the peripheral direction.

7. A clutch disk assembly as claimed in any one of claims 1 to 6, wherein the idling damping springs (13) coupling the disk parts (10, 11, 12) to one another with idling rotational play rest with initial tension in the recess (34) in the first disk part (10, 11) and fix the friction segment (28) in this recess (34) in the peripheral direction.

8. A clutch disk assembly as claimed in claim 7, wherein the force exerted peripherally on the friction segment (28) by the initial tension is greater than the force exerted on the friction segment (28) by the friction.

9. A clutch disk assembly as claimed in any one of claims 1 to 8, wherein the friction segment (28) couples the idling damping spring (13) with idling rotational play to the output disk part (12).

10. A clutch disk assembly as claimed in any one of claims 1 to 9, wherein the idling oscillation damper (15) comprises two input disk parts (10, 11) which are arranged axially on both sides of the output disk part (12) and rest on the friction segment (28) on axially opposed sides and in that the load friction device (18-21) comprises an axially acting spring (18) which at the same time pretensions the two input disk parts (10, 11) against the friction segment (28).

11. A clutch disk assembly as claimed in claim 10, wherein the input disk part (11) provided axially between the output disk part (12) and one lateral disk (7) of the load oscillation damper (5) has flaps (16) which project axially toward the hub disk (2) and have steps (26) which are

adjacent to the other input disk part (11), extend at an axial distance (X) from the friction segment (28) in the new state of the friction segment (28) and serve as an axial stop.

12. A clutch disk assembly as claimed in claim 11, wherein the two input disk parts are constructed as lateral disks (10, 11) which are separated from the hub disk (2) and are provided with apertures (34) for receiving the idling damping spring (13, 14) and in that the flaps (16) provided on one (11) of these lateral disks (10, 11) engage in openings (17) in the hub disk (2) for the non-rotatable connection of these two lateral disks (10, 11) to the hub disk (2) through openings (25) in the other lateral disk (10).

13. A clutch disk assembly as claimed in any one of claims 1 to 12, wherein each friction segment (28) of the idling damping spring 13 adjacently has a substantially disk-shaped spring plate (31) having on one side a contact face (32) for the idling damping spring (13) and on its side remote from the contact face (32) and, with spacing in the peripheral direction of the disk parts (10, 11), contact edges (33) for the recesses (34) of each input disk part (10, 11).

14. A clutch disk assembly substantially as described with reference to the accompanying drawings.

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